

CE Marking: A New Quality Standard

We were the first connector manufacturer in Europe to adopt the new CE marking standard across our structural products range and the first in the UK to manufacture fully CE marked products and throughout this edition of our technical guide you will see many items indicated so.

Our European Test Laboratory located in Tamworth, Staffordshire is the first manufacturer's facility to achieve international standard BS EN ISO/IEC 17025:2005 - which means we are accredited to carry out testing for CE marking and development testing acceptable to all members of The European Organisation for Technical Approvals - who issue European Technical Approvals (ETA's) for products.

By continually demonstrating our industry leading approach to design and manufacturing and through significant investment in our own testing facilities, we have become the only Company to have so much trust placed in our own standards and processes.

All this is your guarantee that our structural products meet all the building regulations and standards, and your assurance that at Simpson Strong-tie we never take quality for granted.



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Background

In 1985 a “New Approach to Technical Harmonization” was introduced through the European Commission (EC). A list of Directives was formulated for a wide range of product types. E.g. electrical goods, toys...

One of these Directives was the Construction Products Directive (CPD).

In 1988 the European Committee for Standardisation (CEN) commenced preparation of Harmonised Standards for a number of product types.

The standards define the requirements to determine suitability of the products for use under the Construction Products Directive. They also make provision for CE Marking of products to demonstrate the product conforms to the Essential Requirements of the CPD. Harmonised Standards have not been developed for all products but it is possible to obtain European Technical Approvals (ETA) when a European Technical Approval Guideline (ETAG) exists.

Simpson Strong-Tie’s range of products is mainly covered by the following European Standards and ETAG’s which have been used as the basis for capacity determination and CE Marking:

BS EN 845-1 Specification for Ancillary Components for Masonry
ETAG015 Three Dimensional Nailing Plates

Design Methods

European Design Standards, Eurocodes, are also being developed which will become compulsory early in 2010 and supersede the existing national design codes.

The Eurocodes which impact on the Simpson Strong-Tie range of products are:

EN1993 Eurocode 3 Design of Steel Structures
EN1995 Eurocode 5 Design of Timber Structures
EN1996 Eurocode 6 Design of Masonry Structures

Most of the current UK national design standards are based on limit state design except for BS5268 for Structural Timber Design which still uses allowable stress methods. Eurocode 5 introduces limit state design principles to structural timber design in the UK for the first time. This requires the designer to use characteristic values for the product capacities. The characteristic capacities (or resistances) are modified by partial safety factors to arrive at design capacities. These factors generally increase the loads and decrease the capacity.

In timber design the duration of loading also influences the design capacity and a modification factor is applied dependent on the duration.

Connector down loads are typically Medium Term Duration with a $k_{mod} = 0.8$

Connector uplift are typically Short Term Duration with a $k_{mod} = 0.9$

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The latest (2008) catalogue generally presents characteristic resistances for timber to timber connectors as Modified Characteristic Resistances i.e. the characteristic value having been modified by the appropriate k_{mod} factor. Please note the k_{mod} factor does not apply to masonry hangers and connectors.

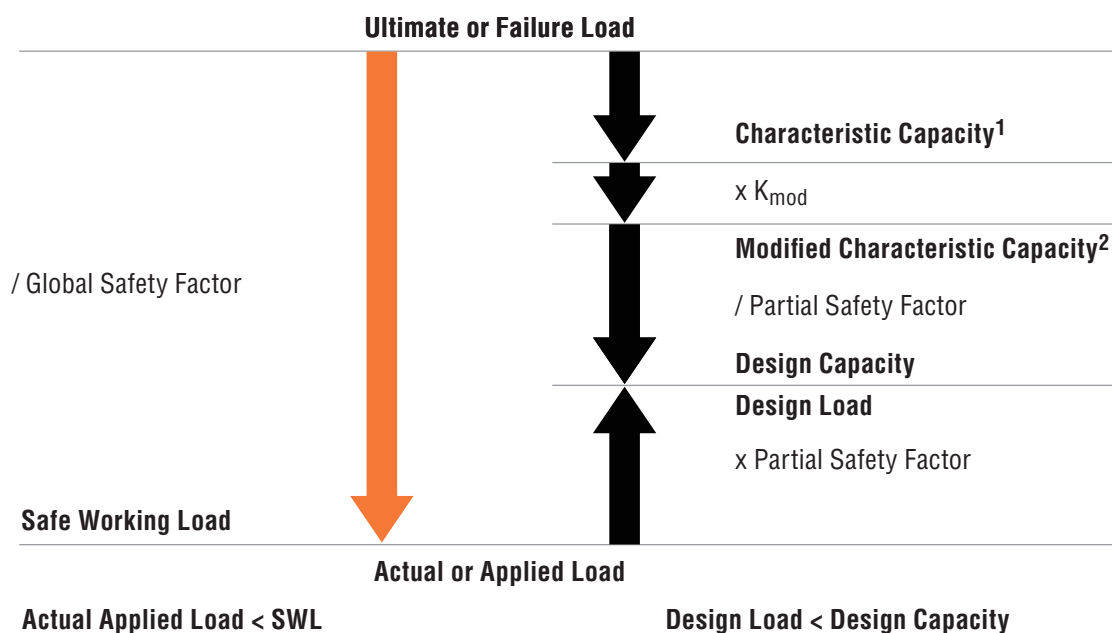
Actual Applied Loads x Partial Safety Factor on Loads = **Design Load (or Factored Load)**
 Characteristic Capacity x k_{mod} / Partial Safety Factor on Materials = **Design Capacity**
 OR Modified Characteristic Capacity / Partial Safety Factor on Materials = **Design Capacity**
Design Load < Design Capacity

In previous catalogues we published only **Safe Working Loads**.

NOTE It is important Characteristic or Design Capacities are not compared with Actual Applied Loads when selecting and designing a connector. Design Capacities i.e Characteristic Capacities factored as described above, shall only be used to check against factored design loads.

The Allowable load design method utilises a **Global Safety Factor** to reduce the Ultimate or Failure Load to a **Safe Working Load**, this must be greater than the Actual Applied Load.

The 2 methods can be compared graphically using the diagram below:



NOTE

1. Value used for masonry connectors as k_{mod} does not apply.
2. Value used in catalogue for timber to timber connectors unless described otherwise.

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Limit State Design Hanger Design Example

INTRODUCTION

The basis of limit state design for timber to timber hangers is to check the following condition:

Design Load < Design Capacity

WHAT IS A DESIGN LOAD?

Loads on a structure are generally divided into **Permanent** and **Variable**.

Permanent Loads, denoted by G_k , are dead loads including self weight, finishes etc

Variable Loads, denoted by Q_k , are the imposed, snow and wind loads.

Guidance on values to be used for the loads is given in: **Eurocode 1: Actions on Structures**

Typical values used in the design of a domestic timber floor are:

Imposed Load: 1.5 kN/m²

Dead Load: 0.75 kN/m² Actual value depends on the type and size of joists, plasterboard and decking etc.

These are known as the characteristic loads.

The characteristic loads are multiplied by partial safety factors that take account of the possibility of the load being greater than predicted and also the effect of combinations of different loads.

The partial safety factors are obtained from: **Eurocode 0: Basis of Structural Design**

The values can vary dependent on load combinations but typical values are:

Partial Safety Factor on Permanent Loads $\gamma_G = 1.50$

Partial Safety Factor on Variable Loads $\gamma_Q = 1.35$

The Design Load on an ITT joist hanger supporting joists at 0.6m centres, with a span of 4m, Permanent Loads of 0.75 kN/m² and Variable Loads of 1.5 kN/m² is as follows:

$$\begin{aligned}
 \text{Hanger Design Load} &= (\gamma_G \times G_k) + (\gamma_Q \times Q_k) \\
 &= (\gamma_G \times G_k \times (\text{span} \times 0.5) \times \text{joist centre's}) + (\gamma_Q \times Q_k \times (\text{span} \times 0.5) \times \text{joist centre's}) \\
 &= (1.50 \times 0.75 \times (4.0 \times 0.5) \times 0.6) + (1.35 \times 1.5 \times (4.0 \times 0.5) \times 0.6) \\
 &= 1.35 + 2.43 \qquad \qquad \qquad = \mathbf{3.78 \text{ kN}}
 \end{aligned}$$

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Limit State Design Hanger Design Example - Continued

WHAT IS A DESIGN CAPACITY?

The Design Capacity of a Hanger is determined as follows:

The characteristic capacity R_k is modified by a factor k_{mod} that takes account of the duration of loading.

k_{mod} factors are obtained from :

Eurocode 5: Design of Timber Structures , Part 1 Table 3.1

Modified Characteristic Capacity $R_{k,mod} = R_k \times k_{mod}$

The duration factor is also governed by the moisture content defined by Service Classes which specify the environment within which the timber structure exists. Service Class 1 or 2 is assumed for the values within the Simpson Strong-Tie catalogue.

Floor down loads are defined as Medium Term duration, $k_{mod} = 0.8$

Uplift Wind Loads are defined as Short Term duration, $k_{mod} = 0.9$

The Simpson Strong-Tie catalogue includes modified characteristic capacities for timber to timber connectors. Download values have been modified for Medium Term load duration and Uplift values have been modified for Short Term duration using k_{mod} of 0.8 and 0.9 respectively which applies to both Service Classes 1 and 2.

(Please note that the modification factor for duration does not apply to masonry hangers and therefore the catalogue quotes characteristic capacity.)

The Characteristic Capacity is further modified by a Material Partial Safety Factor γ_M that takes account of possible adverse variations from the assumed material properties.

The factor is obtained from Eurocode 5 Table 2.3, For LVL $\gamma_M = 1.2$, For Solid Sawn $\gamma_M = 1.3$

$$\text{Hanger Design Capacity } R_d = \frac{R_k \times k_{mod}}{\gamma_M} \quad \text{OR} \quad R_d = \frac{R_{k,mod}}{\gamma_M}$$

For an ITT Hanger:

From the catalogue Modified Characteristic Capacity on LVL Flanged 'I' Joist Header = 7.84 kN

$$\begin{array}{lcl} \text{ITT Design Capacity } R_d & = & 9.8 \times 0.8 / 1.2 \quad \text{OR} \quad 7.84 / 1.2 \\ & = & \mathbf{6.53 \text{ kN}} \quad \quad \quad \mathbf{6.53 \text{ kN}} \end{array}$$

DESIGN CHECK

Check Design Load < Design Capacity

Design Load = 3.78 kN, Design Capacity = 6.53 kN. **Therefore OK**